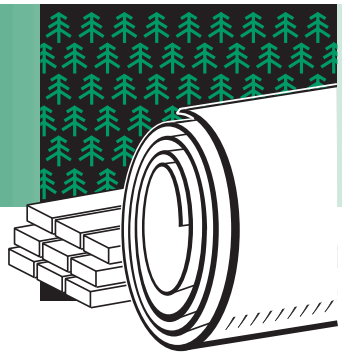
FOREST PRODUCTS

Project Fact Sheet



Assessing the Significance of Below-Ground Carbon Allocation of Fast- and Slow-Growing Families of Loblolly Pine

Benefits

- Usefulness of the TREGRO model in a variety of Atlantic Coastal sites region with different environmental conditions
- Greater understanding of the physiology of loblolly pine root systems
- Identification of genetic markers that control traits important for optimal forest productivity

Applications

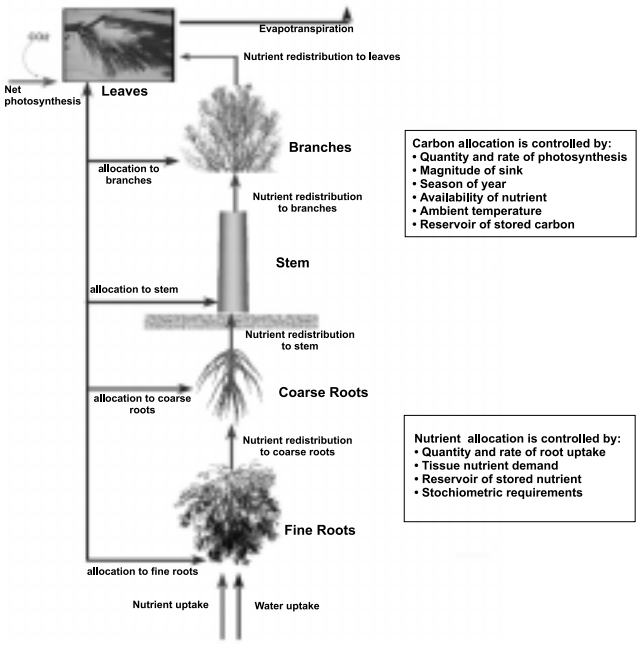
Industry will be able to take advantage of the stocks of loblolly pine developed during this project whose growth rates are optimal because the physiology and genetics of the stocks have been matched to the environmental conditions in which they grow.

Greater understanding of the physiology of pine root systems will promote forest productivity

In order to clone stands of loblolly pine with genetically superior growth characteristics, the forest products industry needs a thorough understanding of the physiology of the species and of how it achieves maximum growth under various environmental conditions. There are regional variations in growth rates among the more than 12.3 million hectares of loblolly pines in the Atlantic Coastal Plain. While studies have been done to correlate growth of above-ground tree structures in different genotypes with the efficient use of water and nutrients, no one has looked at genetic control of growth in below-ground root systems. In particular, research is needed to study how carbon is allocated below ground when both fast-growing and slow-growing stands of pines are fertilized. Is the growth of roots under genetic control regardless of the soil amendments, or does fertilizer stimulate growth in fine roots at the expense of another carbon sink such as stems and foliage?

Investigators will study field trees in North Carolina as well as seedlings in nurseries and greenhouses to answer these questions. This research will help determine if there are functional differences in the way different populations of trees acquire water and nutrients.

TREGRO Model



Schematic diagram of the principal pools and flows considered in the TREGRO model.

Project Description

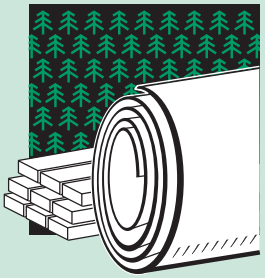
Goal: To assess whether there are differences in the acquisition, whole-plant allocation, and partitioning of carbon in fast- and slow-growing families of loblolly pine, and if fertilization changes these differences.

Seedlings from Texas are proposed to be slow-growing, while it is suggested that seedlings from the Atlantic Coastal region are fast-growing. Above-ground data collected by North Carolina State University will be combined with below-ground data collected during this effort to determine differences among different families of trees.

Evaluations of below-ground biomass and carbon allocation and partitioning will be made over three growing seasons on four different fast- and slow-growing families of loblolly pines found in Scotland County, North Carolina. The trees will be divided into a control group and a group that receives optimal nutrition. Samples of coarse and fine roots will be taken at regular intervals to measure their biomass and nonstructural carbohydrate content. Whole trees will be harvested to obtain estimates of total biomass and to observe any differences in root architecture among tree families. Tubes will be installed to monitor turnover of root systems using minirhizotron technology, and stable isotope analysis will be used to search for functional differences among families in the way their root systems acquire water and nutrients.

Progress & Milestones

- The data will be introduced to the model, TREGRO, which simulates the flux of carbon, water, and nutrients in individual trees, and the model generated will be available to extrapolate the results to other sites on the Atlantic Coastal Plain.
- Similar findings for the root traits and biomass partitioning of both field trees and nursery seedlings would strengthen juvenile/mature correlations and aid in the selection of root traits that would optimize stem growth under specific environmental site conditions.
- This is a three-year project.



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